CLAIMS

1. A system for scanning a target of interest comprising:

a high-resolution collecting optic;

a spatial modulation reticle located in a high-resolution image plane of the collecting optic, the reticle being movable in the image plane;

a demagnifying relay optic;

a primary small-format focal plane array (FPA) detector located in the demagnified image plane that receives reticle-modified images and outputs image frames; and

a processor that performs, with the image frames, balanced demodulation function that reduces image clutter where the target of interest is in motion.

2. The system as set forth in claim 1 wherein the balanced demodulation function comprises:

$$VV = \sqrt{\left(V_2 - \frac{V_1 + V_3}{2}\right)^2 + \left(V_3 - \frac{V_2 + V_4}{2}\right)^2 + \left(V_6 - \frac{V_5 + V_7}{2}\right)^2 + \left(V_7 - \frac{V_6 + V_8}{2}\right)^2}$$

in which

V_r is an output image frame from the FPA on frame number r, and

VV is a demodulated output frame derived from a sequence of 8 image frames.

3. The system as set forth in claim 2 wherein the demodulation function is defined by a predetermined frame delay and wherein a choice of the predetermined frame delay is made according to a known or expected scene motion environment and a known angular subtense of each of a plurality of cells of the reticle so as to maximize a degree of clutter reduction.

4. The system as set forth in claim 1 wherein the processor is adapted to perform enhanced detection of the target-of-interest in motion, wherein a derived motion of the

target-of-interest based upon a detection scenario is used to adjust a motion of the reticle so as to generate a desired result.

5. The system as set forth in claim 4 wherein the motion is derived by monitoring pitch and roll rates of a movable support that carries each of the high-resolution collecting optic, the spatial modulation reticle, the demagnifying relay optic and the FPA detector.

6. The system as set forth in claim1 wherein the reticle includes a plurality alternating transmissive and non-transmissive cells and wherein a size of each of the cells is defined by a desired instantaneous field-of-view (IFOV) and matches an achievable point spread function (PSF) of the high-resolution collection optic.

7. The system as set forth in claim 6 wherein the a cell-to-cell variation in area for each of the cells with respect to all other of the cells is less than 1% and wherein each of the non-transmissive cells are 100% opaque in a spectral band of interest and wherein a transmissivity of each of the transmissive cells varies by no greater than 1 % with respect to the transmissivity of all other of the transmissive cells.

8. A system for spatial modulation of light in a sensor array that scans an image of a scene comprising:

a reticle with fixed cell pattern of opaque and transparent cells, created by deposition, etching and photolithography processes, and having a long stroke drive mechanism to translate the reticle across a full extent of the image of the scene at constant velocity.

9. A system for spatial modulation of light in a sensor array that scans an image of a scene comprising:

a reticle with fixed cell pattern of opaque and transparent cells, created by deposition, etching and photolithography processes, and having a short stroke oscillatory drive mechanism to translate the reticle at least four cell widths at constant velocity plus turn-around-and-velocity-stabilization time at each end of the stroke.

10. A system for spatial modulation of light in a sensor array that scans an image of a scene comprising:

a reticle with fixed cell pattern of opaque and transparent cells; and

an active digital device that provides independent control of each of the cells, the digital device including at least one of micromirror arrays, addressable membrane mirrors and pneumatic liquid crystals.

11. In a sensor array that scans an image of a scene having a reticle composed of a matrix of transmissive and non-transmissive alternating cells arranged so that the matrix measures SMF cells by SMF cells with each of the cells being a predetermined cell width, a back end relay optic that directs light to a detector from the reticle comprising:

a lateral demagnification in the back end optic equal to a ratio of SMF x reticle cell width to a detector pixel pitch.

12. An apparatus for spatial modulation imaging (SMI) including a high-resolution collecting optic, a spatial modulation reticle located in a high-resolution image plane of the collecting optic, the reticle moving in the image plane, a demagnifying relay optic and a primary small-format focal plane array (FPA) detector located in the demagnified image plane, the apparatus further comprising:

a foveal enhanced imaging (FEI) mechanism having an amplitude beamsplitter located either (a) just before or (b) after the reticle moving plane, to split off a fraction of a high-resolution image intensity; and

a spectral band width or polarization component, for retaining the high-resolution image by routing it to one of either a secondary focal plane array detector or a shared portion of the primary FPA.

13. The apparatus as set forth in claim 12 further comprising an additional small-format FPA employed to output the high-resolution image of a selected subarea from the scene, an extent of the subarea being determined by a size of the additional FPA.

14. The apparatus as set forth in claim 13 further comprising a secondary optical path that leads from the beamsplitter through a 1:1 magnification optic to the additional FPA.

15. The apparatus as set forth in claim 14 wherein the additional FPA is located directly on the reticle surface to intercept the high-resolution image and is adapted to be slewed to the desired point in a scene of the high-resolution image.

16. An apparatus for spatial modulation imaging (SMI) including a high-resolution collecting optic, a spatial modulation reticle located in a high-resolution image plane of the collecting optic, the reticle moving in the image plane, a demagnifying relay optic and a primary small-format focal plane array (FPA) detector located in the demagnified image plane, the apparatus further comprising:

a foveal enhanced imaging (FEI) mechanism having an amplitude beamsplitter located either (a) just before or (b) after the reticle moving plane, to split off a fraction of a high-resolution image intensity; and

a spectral bandwidth or polarization component, for retaining the high-resolution image by routing it to a shared portion of the primary FPA.

17. The apparatus as set forth in claim 16 further comprising a secondary optical path that leads from the beamsplitter through a 1:1 magnification optic to the shared portion of the primary FPA.

18. A system for foveal enhanced imaging of a scanned scene in a sensor having a large throughput collection optic and a high-resolution scene image at a reticle plane and a lower-throughput relay optic and low-resolution scene image that follows at a detector, the system comprising:

a mechanism that employs spillover light that is otherwise lost in a transition from the large throughput collection optic and high resolution scene image at the reticle plane to the lower throughput relay optic and low resolution scene image that follows at the detector plane.

19. The system as set forth in claim 18 wherein the mechanism includes one of either a large-diameter folding mirror with a hole in center for capturing the spillover light, or a dichroic beamsplitter with an appropriately transmitting center area, so as to pass the light passing through an acceptance aperture the relay optic while reflecting to the side all the light that falls outside the acceptance aperture of the relay optic, and a slewable relay mirror that refocuses the otherwise-lost light onto a second FPA to display a foveal enhanced image of a selected subarea of the scene.